

ABSTRACT OF THE DISCLOSURE

5 A high-speed, three-dimensional, gamma-ray imaging method and system as well as a detector and array of such detectors for use therein are provided which characterize radioactivity distributions in nuclear and radioactive waste and materials facilities by superimposing radiation images on a view of the environment using see-through display screens or shields to provide a stereoscopic view of the radiation. The method and system provide real-time visual feedback about the locations and relative strengths of radioactive sources. The method and system dynamically provide continuous updates to the displayed image illustrating changes, such as source movement. A pair of spaced gamma-ray cameras of a detector subsystem function like "gamma eyes". A pair of CCD cameras may be coupled to the detector subsystem to obtain information about the physical architecture of the environment. A motion tracking subsystem is used to generate information on the user's position and head orientation to determine what a user "sees". The invention exploits the human brain's ability to naturally reconstruct a 3D, stereoscopic image from 2D images generated by two "imagers" separated by a known angle(s) without the need for 3D mathematical image reconstruction. The method and system are not only tools for minimizing human exposure to radiation thus assisting in ALARA (As Low As Reasonably Achievable) planning, but also are helpful for identifying contamination in, for example, laboratory or industrial settings. Other optically-invisible radiation such as infrared radiation caused by smoldering fires may also be imaged. Detectors are manufactured or configured in curvilinear geometries (such as hemispheres, spheres, circles, arcs, or other arrangements) to enable sampling of the ionizing radiation field for determination of positional activity (absolute or relative amounts of ionizing radiation) or spectroscopy (energy distributions of photons). More than one detector system may be used to obtain three-dimensional information. The detector systems are specifically suitable for direct visualization of radiation fields.

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